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APPLICATION NO. 29657
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UNDERGROUND STORAGE SUPPLEMENT to APPLICATION TO APPROPRIATE WATER BY PERMIT

SEE ATTACHMENT FOR ALL RESPONSES

1. State amount of water to be diverted to underground storage from each point of diversion in item 3b of form APP.

   a. Maximum Rate of diversions (1) _____ (2) _____ (3) _____ cfs
   b. Maximum Annual Amount (1) _____ (2) _____ (3) _____ acre-feet

2. Describe any works used to divert to offstream spreading grounds or injection wells not identified in item 7 of form APP.

_____
_____
_____

3. Describe spreading grounds and identify its location and number of acres or location of upstream and downstream limits if onstream.

_____
_____

4. State depth of groundwater table in spreading grounds or immediate vicinity: _____ feet below ground surface on _____ 19 __ measured at a point located within the _____ ¼ of _____ ¼ of Section _____, T _____, R _____, _____ B&M

5. Give any historic maximum and or minimum depths to the groundwater table in the area.
   Location _____ Maximum _____ feet below ground surface on _____ (date)
   Location _____ Maximum _____ feet below ground surface on _____ (date)

6. Describe proposed spreading operation. _____
_____
_____

7. Describe location, capacity and features of proposed pretreatment facilities and/or injected wells. _____
_____
_____

Additional copies of this form and water right information can be obtained at www.waterrights.ca.gov.

8. Reference any available engineering reports, studies, or data on the aquifer involved.

9. Describe underground reservoir and attach a map or sketch of its location.

10. State estimated storage capacity of underground reservoir.

11. Describe existing use of the underground storage reservoir and any proposed change in its use.

12. Describe the proposed method and location of measurement of water placed into and withdrawn from underground storage.

Attachment to Underground Storage Supplement
to Accompany 3rd Amended Water Right Application 29657
by County of San Joaquin & Assignees

1. State amount of water to be delivered to underground storage from each point of diversion in item 3b of form APP.

The maximum rate of diversion for all points of diversion combined will not exceed 350 cfs. The maximum annual amount will not exceed 147,000 acre-feet.

2. Describe any works used to divert to off-stream spreading grounds or injection wells not identified in Item 7 of form APP.

Natural waterways including the Mokelumne River, Calaveras River, Mormon Slough, Mosher and Bear Creeks and numerous on-stream diversion facilities and check dams as described on attachment to form APP and shown on sheet 2 of the maps accompanying this Application and irrigation canals operated by Woodbridge Irrigation District and North San Joaquin Water Conservation District (NSJWCD) will provide opportunities for infiltration and groundwater recharge.

3. Described spreading grounds and identify its location and number of acres or location of upstream and down stream limited if on-stream.

Percolation is known to occur within the Mokelumne River below Camanche Dam, within the Calaveras River and Mormon Slough below the Bellota Weir and within Mosher and Bear Creeks. The proposed project will enhance these percolating opportunities by providing water when it would otherwise not be there. Approximate upstream and downstream limits of recharge along these streams are identified on sheet 1 of the maps accompanying this Application as points #3(a) & #3(b) (Mokelumne River), #4(a) #4(b) (Calaveras River and Mormon Slough), #7(a) and #7(b) (Bear Creek) & #8(a) and #8(b) (Mosher Creek). The irrigation canal systems supplied with water obtained from the Mokelumne River at the NSJWCD pump stations (Points MR-01, MR-02), at the Nakagawa pump station (MR-03) and at the Woodbridge Irrigation District diversion dam (Point MR-04) provide significant groundwater recharge. The Calaveras River between points 4(a) and 4(b) has 10 existing check dams, Mormon Slough contains 13 existing check dams between points 4(a) and 4(b), and Mosher Creek has 8 check dams between points 8(a) and 8(b). These check dams are owned and operated by Stockton East Water District who will be the main customer for water diverted and delivered pursuant to any Permit issued pursuant to Application 29657. The locations of these dams are shown on sheet 2 of the maps accompanying this Application and are described by California Coordinates.

4. State depth of groundwater table in spreading grounds or immediate vicinity:

Groundwater elevations within the gross place of use for the fall of 2003 were obtained from the San

Joaquin County Flood Control and Water Conservation District and are shown on sheet 1 of the maps accompanying this Application. Groundwater elevations vary across the place of use between -89 MSL within the deepest cones of depression to -20 near the western boundary of the place of use to +80 MSL near the eastern boundary of the place of use and correspond to a depth below ground surface of about 150 feet, 20 feet and 80 feet respectively.

5. Give any historic maximum and or minimum depths to the groundwater table in the area.

The estimated "predevelopment" water table is as shown on the attached Figure 11 taken from U.S. Geological Survey Professional Paper 1401-A. The elevation of the predevelopment water table varied from about elevation 0 on the west near the San Joaquin River to about elevation 160 on the east near the alluvium-bedrock interface. These contours are shown on sheet 1 of the maps accompanying this Application. The predevelopment depth to groundwater varied from about 0 on the west near the San Joaquin River to about 20 feet on the east near Bellota.

Groundwater data provided by the San Joaquin County Flood Control and Water Conservation District shows that in the fall of 2003, depth to groundwater was about 20 feet on the westerly edge of the basin, and about 80 feet at the easterly side of the basin near Bellota with the depth to groundwater at the deepest cone of depression about 150 feet. Although groundwater levels fluctuate from year-to-year based on hydrologic conditions, it is assumed that the fall 2003 groundwater levels are at or near the historic maximum depth to groundwater.

6. Describe proposed spreading operation.

As described in Item 3, water will be recharged by percolation in the natural channels and irrigation canals identified in this application with detention of water by numerous existing check dams located along the length of the channels. Groundwater recharge will also result from deep percolation of applied surface water within the place of use.

7. Describe location, capacity and features of proposed pretreatment facilities and/or injection wells.

No pretreatment facilities or injection well facilities are planned for this project.

8. Reference any available engineering reports, studies, or data on the aquifer involved.

Department of Water Resources Bulletin No. 146, San Joaquin County Groundwater Investigation, July 1967, provides a comprehensive description of regional geology and groundwater conditions in the project vicinity as of the mid-1960s. Reference is also made to U.S. Geological Survey Professional Paper 1401-A, Groundwater in the Central Valley, California, A Summary Report,

Regional Aquifer-System Analysis, 1991. Both of these documents describe groundwater declines in the region as a result of 20th century municipal and agricultural development.

The report entitled San Joaquin County Flood Control and Water Conservation District Water Management Plan, Phase 1 - Planning Analysis and Strategy, October 2001, prepared by Camp, Dresser and McKee (CDM Report) provides more recent characterization of groundwater conditions. In addition, the report entitled Farmington Dam and Reservoir, California, WRDA 1996 Section 422 - Conjunctive Use Study prepared for the U.S. Army Corps of Engineers by Montgomery Watson - CH2M Hill, and the report entitled Farmington Groundwater Recharge and Seasonal Habitat Study, Final Report, August 2001 by Montgomery Watson Harza (MWH Report), discuss alternative ways to implement groundwater recharge in the project area. Reference is made to the bibliographies of the CDM Report and MWH Report, copies of which are attached for reference.

9. Describe underground reservoir and attach map or sketch of its location.

A general discussion of aquifer characteristics within the San Joaquin Valley is provided in the California Department of Water Resources Bulletin 118 (Update 2003). Aquifers are generally described as being "quite thick" with "groundwater wells commonly extending to depths up to 800 feet." The groundwater contours for the fall of 2003 provided by the San Joaquin County Flood Control and Water Conservation District and shown on sheet 1 of the maps accompanying this Application show a large cone of depression located generally east of the City of Stockton extending to depths greater than 80 feet below sea level.

A more detailed description of geologic and groundwater conditions for the project area is presented in DWR Bulletin 146. In general, the fresh water-bearing formations in the project area extend to a depth of about 1,000 feet below ground surface, and include the Mehrten, Laguna, and Tulare formations, alluvial fan deposits, and stream channel deposits. The base of the fresh water-bearing units is considered to be the Mehrten formation, which overlies saline or brackish water-bearing units.

Figure 8 of Bulletin 146 (copy attached) shows contours on the base of fresh water. For purposes of this application the surface represented by these contours is considered to be the bottom of the underground storage reservoir. Figure 11 from USGS Professional Paper 1401-A (copy attached) shows estimated predevelopment groundwater contours. These contours are considered to represent the top of the groundwater storage reservoir and are shown on sheet 1 of the maps accompanying this application. Based on depth-specific yield information provided in Appendix 3 of DWR Bulletin 146, the total capacity of the underground reservoir within the gross limits of the place of use for this application is about 32 million acre-feet.

Sheet 1 of the maps accompanying this Application shows groundwater contours for the project area based the fall 2003 groundwater measurements provided by the San Joaquin County Flood Control and Water Conservation District. The difference between the fall 2003 groundwater level and the predevelopment groundwater level represents the approximate gross vertical limits of the "active"

reservoir to be managed under this project. Based on depth-specific yield information provided in Appendix 3 of DWR Bulletin 146, the estimated capacity of the active reservoir within the limits of the place of use for this application is estimated to be about 1.9 million acre-feet. The gross surface area of the underground reservoir corresponding to the place of use boundary totals about 399,700 acres.

10. State estimated capacity of underground reservoir.

See response to Item 9 above.

11. Describe use of the underground storage reservoir and any proposed changes in its use.

The CDM Report states that groundwater resources in San Joaquin County are in a state of overdraft. It is estimated that between 1970 and 1993, approximately 2,800,000 acre-feet of groundwater was mined, or otherwise "lost" due to lateral inflow of poorer quality groundwater from the Delta area to the west. The CDM Report projects that continuance of current groundwater and surface water management practices will result in the depletion of an additional 2,000,000 acre-feet by 2030.

The offstream reservoir and underground storage reservoir will enable San Joaquin County to reduce or eliminate surface water diversions pursuant to this Application in dry or critical years and use available groundwater supplies instead. The future use of the basin is expected to be consistent with historical use.

12. Describe the proposed method and location of measurement of water placed into and withdrawn from underground storage.

San Joaquin County currently runs an integrated surface water/groundwater flow model using the DYNFLOW code. The San Joaquin County DYNFLOW model (Model) can be used to simulate proposed groundwater recharge and/or withdrawal projects in Eastern San Joaquin County Groundwater Basin. Surface water delivered to the County would be infiltrated utilizing groundwater spreading basins or injection wells. Knowing the precise location, volume, and duration of groundwater recharge, the Model would be used to simulate the corresponding increase in groundwater levels (mounding) due to increased groundwater recharge. The Model uses transient hydrology and therefore can also be used to assess changes in groundwater levels over time.

The Model can also simulate the subsequent extraction and corresponding beneficial use of groundwater. Groundwater extraction is applied in two different ways in the Model. The Model can be used to simulate the extraction of groundwater based upon the known operation of metered wells in the County. The model also simulates extraction from unmetered agricultural wells. This agricultural pumping is calculated as the crop demand that exceeds applied surface water irrigation. The volume of groundwater extraction applied and calculated in the Model would be compared to

the simulated recharge project volume and a no project baseline. This comparison would be used to determine the total amount of project water extracted and the portion lost to basin outflow. The simulated extraction of groundwater in the recharge area could be spatially compared to water district and agency boundaries to determine the beneficiaries of the recharged groundwater.

The use of the San Joaquin County's existing integrated surface water/groundwater model will ultimately demonstrate the efficiency of recharge, losses due to basin outflow, the new volume removed from storage for beneficial use, and the spatial distribution of this additional project recharge water.

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